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PTO/SB/21 (08-00)

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/837,974
Filing Date	04/19/2001
First Named Inventor	Hiroshi Horie et al.
Group Art Unit	3682
Examiner Name	J. Stefanon
Attorney Docket Number	TWA26USA

Total Number of Pages in this Submission

ENCLOSURES *(check all that apply)*

- ☒ Fee Transmittal Form
  - ☒ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/Incomplete Application
- ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Assignment Papers (for an Application)
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
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- ☐ After Allowance Communication to Group
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
- ☐ Proprietary Information
- ☐ Status Letter
- ☒ Other Enclosure(s) (please identify below):
  - Brief on Appeal
  - Check for $330.00
  - Brief in triplicate

Remarks:

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm *or* Individual Name	George A. Smith, Jr.
Signature	[signature] 24442
Date	12/09/03

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Signature	[signature]	Date	12/09/03

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 330.00

Complete if Known	
Application Number	09/837,974
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METHOD OF PAYMENT *(check all that apply)*

☑ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

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Deposit Account Number: Howson and Howson

Deposit Account Name: 08-3040

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X	=
Independent Claims		- 3** =		X	=
Multiple Dependent					=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	330.00
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 330.00

SUBMITTED BY

(Complete *(if applicable)*)

Name (Print/Type)	George A. Smith, Jr.	Registration No. (Attorney/Agent)	24,442	Telephone	215-540-9200
Signature				Date	12/9/03

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#14/Appeal Brief 12-23-03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of
H. Horie et al.

Serial No.: 09/837974

Filed: April 19, 2001

For: SILENT CHAIN
POWER TRANSMISSION APPARATUS

Examiner:
J. Stefanon

Art Unit: 3682

CERTIFICATE OF MAILING
UNDER 37 C.F.R. §1.8(a)(1)(ii)
(PATENT)

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Signed _____

Date Dec 9, 2003

BRIEF ON APPEAL

(1) Real party in interest

The real party in interest is the Applicants' assignee, Tsubakimoto Chain Co., a Japanese corporation located at Osaka Fukokuseimei Building 2-4, Komatsubara-cho, Kita-ku, Osaka 530-0018, Japan.

(2) Related appeals and interferences

None.

(3) Status of claims

The pending claims are claims 1 and 2. Both claims are rejected and the rejection of both claims is the subject of this appeal. Claim 3 has been canceled.

(4) Status of Amendments

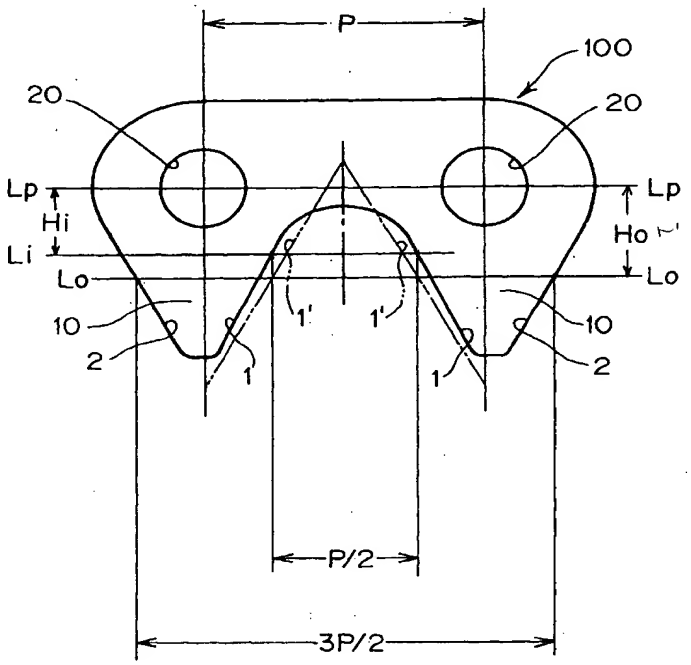
There are no outstanding amendments.

(5) Summary of Invention

A silent chain, also known as an inverted tooth chain, is composed of interleaved W-shaped link plates, as shown in FIG. 7, each plate having a pair of pin holes for receiving

interconnecting pins, and a pair of teeth for engagement with a sprocket.

FIG.7
(Prior Art)



In a typical power transmission application, such as the valve timing system of an automobile engine, the silent chain meshes with sprockets formed by hobbing. (Spec., page 1, lines 5-7; page 2, lines 10-12)

The pitch P of the link plate is the distance between the centers of the pin holes 20, measured along a center line Lp. In the typical silent chain, the inside flanks 1 are located outward relative to imaginary lines 1', which are symmetrical with the outer flanks 2. The inside flanks are always overlapped by the outside flank of an adjacent link plate, and only the outside flanks 2 of the link plates engage the sprocket teeth. As a result, the inside pitch line Li, which is the line, parallel to the pin center line Lp, and

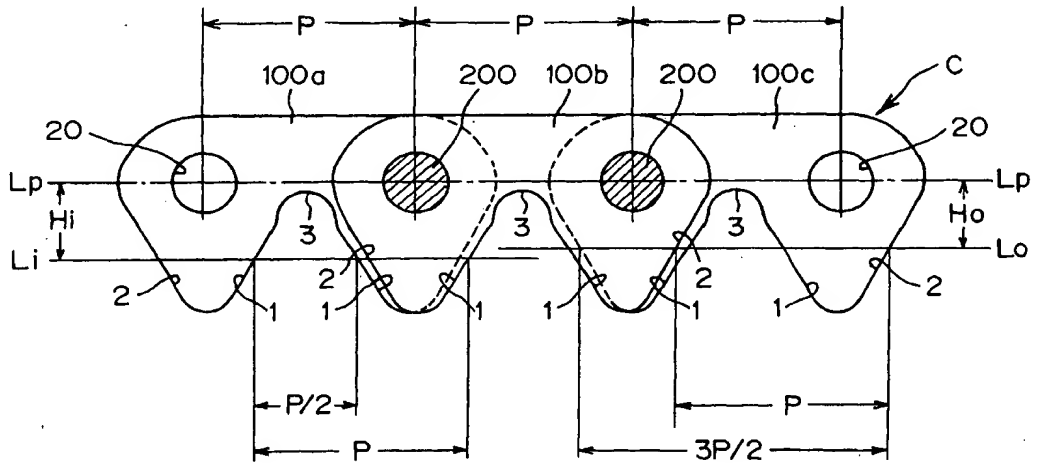
intersecting the inner flanks at a location where the distance between the inner flanks is equal to P/2, is relatively close to the center line Lp, compared to the outside pitch line Lo, which is the line intersecting the outer flanks at a location where the distance between the outer flanks is 3P/2. The distance between the center line Lp and the inside pitch line may be defined as Hi, and the distance between the center line Lp and the outside pitch line may be defined as Ho. In the conventional silent chain, Hi is always less than or equal to Ho ($Hi \leq Ho$). (Spec., pages 1-2)

In the conventional chain transmission, as the sprocket rotates through an angle $\alpha/2$ (α being the sprocket pitch angle), from the position shown in FIG. 8 to the position shown in FIG. 9, the center of pin 200a moves downward through a distance $Hs=U-V$, where $U=\frac{P}{2\sin(\frac{\alpha}{2})}$ and $V=\frac{P}{2\tan(\frac{\alpha}{2})}$. As a result of this motion, known as "polygonal motion," the free span of the conventional chain moves in the up and down direction as it approaches the sprocket. This up and down motion of the free span of the chain causes undesirable vibration and impact noise, and shortens the life of the chain. (Spec., page 2, line 17, page 4, line 6)

One attempt at solving the problem of up and down motion was to form the sprocket using a rack cutter, so that its tooth profiles were identical to the profiles of the link plates when the chain is stretched linearly. However, this measure afforded only a partial solution to the problem of up and down movement of the chain. (Spec., page 4, line 7 - page 5, line 7.

This invention takes a different approach. In contrast to the conventional link plate, where Hi ≤ Ho, in the link plate of the invention, as shown in FIG. 1, the inner flanks are configured so that the distance Hi, from the pin center line Lp to the inside pitch line Li, is greater than Ho, the distance from the pin center line Lp to the outside pitch line Lo.

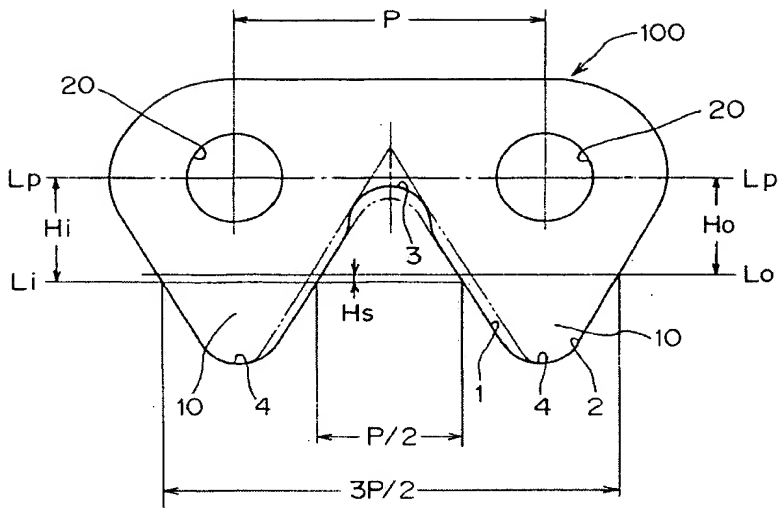
FIG. 1



More specifically, as shown on the following page in FIG. 2, the relationship between the inner and outer pitch lines is such that Hi = Ho + Hs, Hs being the amplitude of polygonal motion of the chain on the sprocket[1]. (Spec. page 13, lines 14-22)

[1]In FIG. 2, the outer pitch distance, 3P/2, is erroneously illustrated. Both limits should have extended to the outside pitch line Lo.

FIG.2

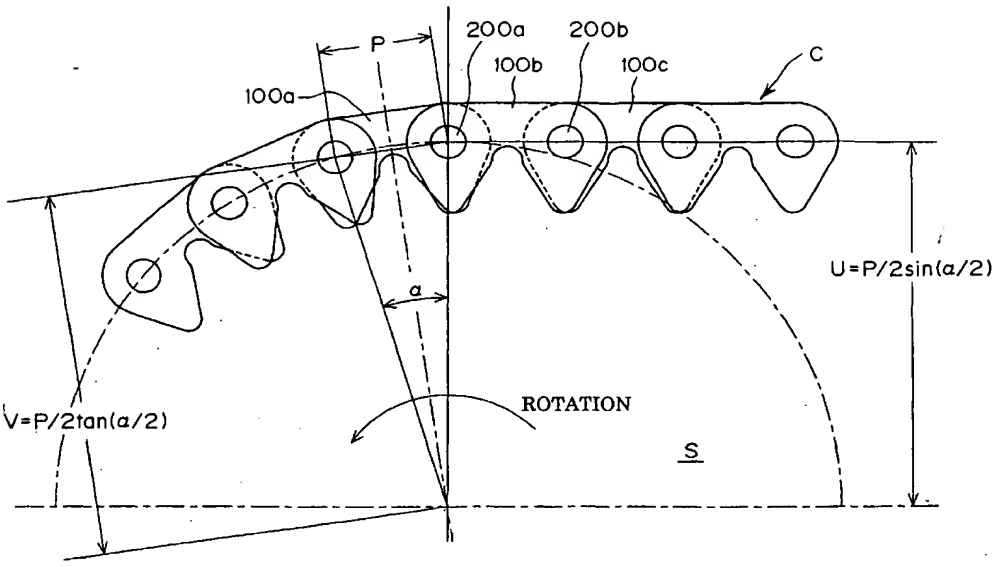


In addition, when the chain is straight, the tooth faces of the links of the chain conform to the profiles of axially, linearly arranged teeth of the hob cutter used to form the teeth of the sprocket. (Spec., page 15, lines 12-14). Moreover, as shown in FIGs. 1, 2 and 6, the concave bottom surface of the link plate is scooped out more deeply than an arc tangent to the inside tooth faces. (Spec., page 14, lines 6-15).

In the operation of the invention, since the distance Hi, from the inside pitch line Li to the pin center line Lp, is greater than the distance Ho, from the outside pitch line Lo to the pin center line Lp, by an amount corresponding to the amplitude Hs of polygonal motion of the chain on the sprocket, that is, Hi = Ho + Hs, the leading inside tooth face of each link plate is held against a mating sprocket tooth as the link plate meshes with the sprocket. As a result, the link plates remain constantly at the height U during the initial part of the meshing engagement. For example, the leading inside tooth face of link plate 100c, as shown in FIG. 4, engages a sprocket tooth, and this engagement keeps the link plate 100c

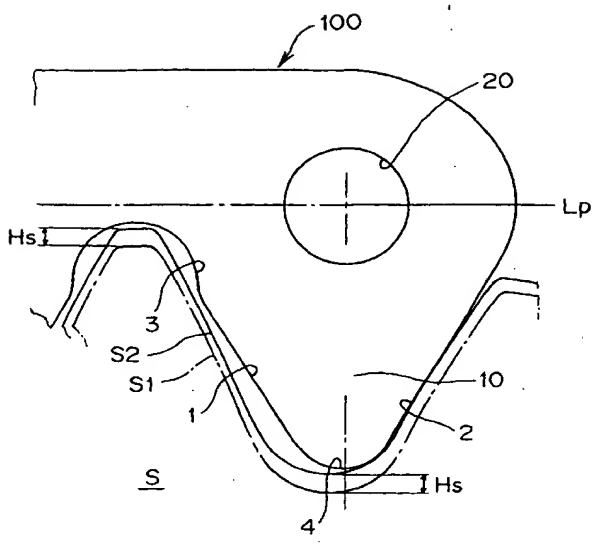
at a constant height U as its pin 200b arrives at the position where pin 200a was.

FIG.4



The leading inside tooth faces move away from the sprocket teeth as the chain bends around the sprocket (page 17, lines 26 - 27), and polygonal motion commences as the link plates become seated on the sprocket with their outer tooth faces in engagement with the sprocket teeth. However, as shown in FIG. 6, where the link plate is shown with one of its outer tooth faces engaged with a sprocket tooth, even though the inside tooth faces conform to the shape of the hob teeth used to make the sprocket, the scooped out bottom surface 3 of the link plate prevents the polygonal motion, which has an amplitude Hs, from resulting in interference between the sprocket teeth and the concave bottom surfaces of the link plates. (Spec., page 18, line 10 - page 19, line 14)

FIG.6



In summary, the invention embodies a combination of three distinct features: the conformity of the chain teeth to the hob used to make the sprocket; the location of the inside pitch line farther from the pin center line than the outside pitch line by a distance equal to the amplitude of polygonal motion; and the scooped out concave bottom surface of the link plate. This combination results in a silent chain exhibiting reduced noise and vibration, and improved durability.

(6) Issues

The sole issue in this appeal is whether or not the differences between the subject matter as defined in claim 1, and the prior art as represented by the three cited references, is such that the claimed subject matter as a whole would have been obvious to a person having ordinary skill in the art of designing silent chain power transmissions.

(7) Grouping of Claims

Claims 1 and 2 are grouped together; no separate reason is presented in support of claim 2.

(8) Argument

"In holding an invention obvious in view of a combination of references, there must be some suggestion, motivation, or teaching in the prior art that would have led a person of ordinary skill in the art to select the references and combine them in the way that would produce the claimed invention. . . It is insufficient that the prior art disclosed the components of the patented device, either separately, or used in other combinations; there must be some teaching, suggestion, or incentive to make the combination made by the inventor." Karsten Manufacturing Corp. v. Cleveland Golf Co., 1242 F3d 1376, 58 USPQ2d 1286 (Fed. Cir. 2001).

The final rejection is under 35 USC §103, and based upon a combination of three references, U.S. patents 3,661,025 (Avramidis) and 5,628,702 (Kotera), and Japanese Doc. No. 2000-65156 (Matsuda)[2].

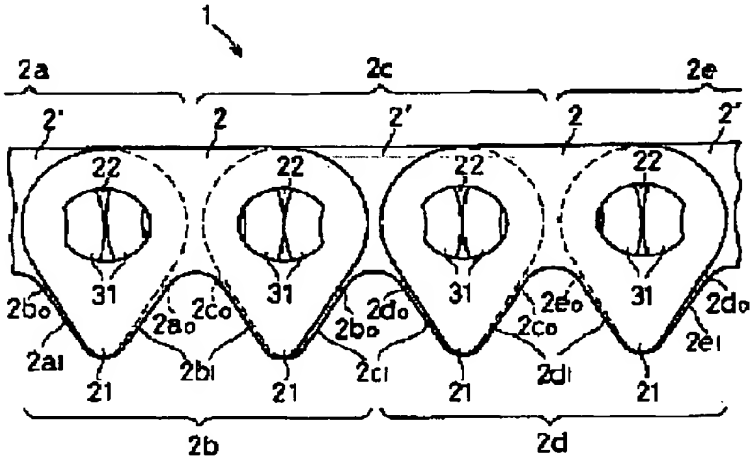
Avramidis relates primarily to a bushing structure in a silent chain, but discloses a silent chain having links with steep outer tooth faces, and inner tooth faces which are much less steep than the outer tooth faces. The inner tooth faces are connected by a scooped-out arc, apparently to provide clearance for the sprocket teeth.

Kotera describes a silent chain in which the inside flanks of the link plates are convex and protrude beyond the outside flanks of adjoining link plates so that the inside flanks of the links contact the sprocket teeth first at the beginning of engagement of the sprocket, thereby pushing up the chord of the chain and reducing chordal motion. The link

[2]For convenience, U.S. patent 6,244,983 may be referred to as an English language counterpart to the cited Japanese document.

plates then become seated on the sprocket with their outside flanks contacting the sprocket teeth. (Kotera col. 2, lines 31-39) As the Examiner has pointed out, this structure inherently provides a pitch line relationship in which the distance between the pin center line and the inner tooth pitch line is greater than the distance between the pitch cent r line and the outer tooth pitch line by a constant amount. That is Hi= Ho + K.

In Matsuda, a silent chain is designed so that the engaging point between the link and the sprocket is always on the inner link flank from initial engagement to full engagement (U.S. patent 6,244,983, col. 2, lines 49-51). As seen in FIG. 3, the inner flank has a shape that does not conform to the sprocket tooth. As shown in FIGs. 9-12, the inner flank of the link plate progressively rolls on the sprocket tooth, and is ultimately engaged with the tip portion of the sprocket tooth. At column 1, lines 43 - 50, by way of background, Matsuda mentions an earlier proposal in which the flank side on each link series which engages with a sprocket when the silent chain is extended in a linear form has the same shape as the part of the tooth shape fo a rack cutter capable of generating the sprocket. The earlier proposal is depicted in the following drawing from Japanese published application Hei 8-184,348:



(DRAWING FROM HEI 8-184,348)

The reasoning underlying the Examiner's rejection is essentially that Avramidis discloses a chain having the arc-shaped scoop; Kotera discloses the pitch line relationship Hi = Ho + K (K being positive); it would have been obvious to modify the chain of Avramidis so that it has the pitch line relationship taught by Kotera, and to make K equal to the amplitude Hs of the chain's polygonal motion; and to make the inside tooth faces with the same shape as that of a rack cutter capable of generating the sprocket as taught by Matsuda (by Matsuda's reference to Hei 8-184,348).

The errors in the rejection are that the conclusion of obviousness is not based on a suggestion or teaching in the references, and that the rejection does not properly establish obviousness of the Applicants' invention as a whole, as required by 35 USC §103.

In Avaramidis' chain, the inside tooth faces have a slope that is much more gradual than that of the outside tooth faces, and the outside tooth faces project far beyond the inside tooth faces when the chain is straight. The inside tooth faces clearly do not contact the sprocket, not even upon

commencement of engagement. The scooped out arc appears to be necessitated by the very gradual slope of the inside tooth faces. If they were connected by an arc tangent to the tooth faces, the arc would interfere with the sprocket teeth.

On the other hand it may be readily seen that, if the inner flanks of one of Avramidis' link plates are brought toward each other to make the chain more like that of Kotera, the scooped out arcs become tangent to the inner tooth faces, and there is no longer "an arc-shaped surface scooped out more deeply than an arc tangent to said opposed inside tooth faces" as set forth in Applicants' claim 1. The result would not correspond to the claimed subject matter taken "as a whole."

Kotera and Matsuda both lack such arc-shaped surface, and apparently there was no perception in either case that a scooped-out arc would be either necessary or desirable in a chain in which the inner tooth faces project beyond the outer tooth faces when the chain is straight.

It follows that, while the prior art documents individually disclose elements of claimed combination, they lack any teaching, suggestion or incentive to make the claimed combination. Kotera and Matsuda do not themselves suggest the scooped-out arc, nor do they disclose any need for the same. Moreover, if Avramidis were modified in accordance with Kotera, or in accordance with Kotera and Matsuda, the scooped out arcs would disappear; the result would not correspond to the Applicant's claims.

(9) Conclusion

For the reasons set forth above, we respectfully submit that the final rejection was in error and should be reversed.

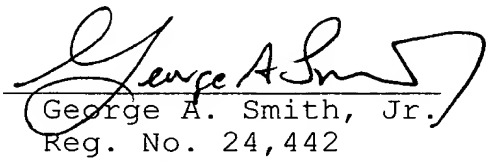
(10) Fees and enclosures

Our check for the fee for filing a brief on appeal, under 37 C.F.R. §1.17(c) is enclosed. If the check is missing or

insufficient, please charge the fee to our deposit account 08-3040.

Two additional copies of this brief are also enclosed.

Respectfully submitted,
HOWSON & HOWSON

By 

George A. Smith, Jr.
Reg. No. 24,442
Howson & Howson
Box 457
Spring House, PA 19477
Telephone: 215 540 9200
Facsimile: 215 540 5818

Enclosures:
(a) 2 additional copies of this brief
(b) appeal fee

APPENDIX

LISTING OF CLAIMS

1(Previously presented). A silent chain power transmission apparatus comprising:

an endless silent chain comprising a multiplicity of link plates connected in interleaved relationship by a multiplicity of connecting pins, each of said link plates having a pair of V-shaped teeth and a pair of pinholes for fitting said connecting pins, the V-shaped teeth of each said pair having opposed inside tooth faces defining insides thereof and outside tooth faces defining outsides thereof; and

a sprocket having a plurality of teeth in intermeshing relationship with said V-shaped teeth of said link plates;

said inside and outside tooth faces being positioned to satisfy the expression Hi = Ho + Hs, where Hi is the distance from a pin center line, passing through the centers of a pair of said connecting pins, to a pitch line of the inside tooth faces of a link plate in which said pair of connecting pins is fitted, Ho is a distance from said pin center line to a pitch line of the outside tooth faces of a link plate in which said pair of connecting pins is fitted, and Hs is the amplitude of polygonal motion of said chain;

each of said link plates having a concave bottom surface continuing from and defined between its opposed inside tooth faces at a position to avoid interference of said concave bottom surface with corresponding tooth edges of said sprocket teeth, which arises due to said polygonal motion when said outside tooth faces of said link plate are brought into meshing contact with said sprocket teeth and become seated thereon; and

said inside tooth faces having profiles identical to tooth profiles, arranged axially, of a hob cutter capable of forming said teeth of said sprocket;

wherein the concave bottom surface of each of said link plates is an arc-shaped surface scooped out more deeply than an arc tangent to said opposed inside tooth faces.

2(Previously presented). A silent chain power transmission apparatus according to claim 1, wherein said V-shaped teeth have tooth edges profiled at a position where interference of said tooth edges with root bottoms defined between opposed ones of said teeth of said sprocket, which arises due to said polygonal motion when said outside tooth faces of said link plates are brought into meshing contact with said opposed ones of said sprocket teeth and become seated thereon, can be avoided.

3(Cancelled).